

REMARKS

The present communication is responsive to the Official Action mailed May 16, 2003. A petition for a three-month extension of the term for response to said Official Action, to and including November 16, 2003, is transmitted herewith. As November 16, 2003, is a Sunday, the present communication is timely if filed on November 17, 2003. Because the Official Action was denominated as a final Official Action, a request for continued examination is transmitted herewith. Accordingly, the finality of said Official Action should be withdrawn and the present amendment should be considered as a response to a non-final Official Action.

Applicant has amended the title of the application to correct a typographical error appearing in the Amendment dated February 25, 2003, by deleting the word "of."

Before addressing the specific rejections set forth in the Official Action, a brief review of certain embodiments of the present invention is believed helpful. Moreover, in this review, applicant addresses the Examiner's request to provide "reference numerals to all the claimed limitations as well as support in the disclosure for better clarity." It should be understood that reference to specific portions of the disclosure or specific features of the drawing (including reference to reference numerals) in this discussion only points to exemplary disclosure of the claimed invention for the Examiner's convenience, and does not in any way limit the claims to the specific examples referred to in this discussion. As an aid to this discussion, a "clean" copy of the presently pending claims is transmitted herewith as Appendix A, with exemplary reference numerals inserted therein. Again, provision of such reference numerals does not in any way limit the scope of the claims.

As explained in the specification, one problem addressed by certain embodiments of the present invention is to

interconnect a microelectronic device such as a semiconductor chip to a supporting substrate as, for example, a "standard printed wiring board." (Application at 1-5.) To provide such interconnection, the present invention, in its preferred forms, makes an assembly as depicted in Figs. 2A and 2B. The assembly has posts 130 projecting upwardly from a first surface of a support structure 100 (not numbered in Figs. 2A and 2B; numbered in Fig. 1B). The first surface is the surface facing upwardly in Figs. 2A and 2B. The support structure, in turn, overlies a microelectronic device as, for example, a semiconductor chip (150; Figs. 2A, 2B) which is positioned on the side of the support structure opposite from the posts. Stated another way, the posts project from a first side of the support structure, whereas the microelectronic device overlies the opposite, second side (the downwardly facing side in Figs. 2A and 2B).

As explained in the specification (e.g., p. 12, lns. 5-15; Figs. 4A, 4B), the assembly made in this way can be connected to a circuit board or other "supporting substrate" by "directly soldering the posts to the contacts pads or inserting them into sockets attached to the substrate." A socketed arrangement is shown in Figs. 4A and 4B, but other connections such as a direct solder connection can also be used. In this assembly, "the peaks of the posts 130" engage the conductive features of the "support substrate." Although Figs. 4A and 4B are detail views, focused on the interconnection between the posts and the support substrate, it is instantly apparent from the structure of Figs. 2A and 2B that when the posts 130 are connected to a further "supporting substrate" or printed circuit board in this manner, the assembly as a whole is mounted to the printed circuit board, and that the posts project to the circuit board and serve to interconnect the assembly as a whole with the circuit board. Stated another way, it is apparent that in, e.g., Fig. 4A, the microelectronic device 150 (Figs. 2A, 2B)

would lie above the upper planar element shown at the top of the drawing, which constitutes the support structure 100 depicted in Figs. 1A-2B. Again, as discussed above and as clearly shown in Figs. 2A and 2B of the drawings, the microelectronic device 150 lies on the side of the support structure opposite from the posts.

A process of forming the posts is addressed at pages 7-9 of the specification. As there disclosed, conductive sheet 110 (Fig. 1A) is provided on the upwardly-facing surface of support structure 100, and a photoresist layer 120 is provided on the surface of conductive sheet 110 opposite from the support structure (the upwardly-facing surface as seen in Fig. 1A). The resist is treated so as to form etch-resistant regions 125 (shown in broken lines in Fig. 1A). As explained in the specification (e.g., p. 8, lns. 9-13), the side of sheet 110 bearing the etch-resistant regions 125 is then etched so as to remove material around the etch-resistant regions 125, while leaving those portions beneath the etch-resistant photoresist portions 125. This leaves posts projecting from the upwardly-facing surface of support structure 100 seen in Fig. 1B, the posts having top surfaces remote from the support structure, i.e., the circular tips shown in Figs. 2A and 2B. The microelectronic device 150 is assembled to the opposite side of the support structure and connected to the posts. In variants (e.g., Fig. 5), the etch-resistant regions can be formed from an etch-resistant metal (e.g., nickel), which remains in place as a "conductive top" (210) on the tip of each post. It is believed that the remaining features set forth in the claims presently under examination will be clear in light of the foregoing exemplary discussion.

By the present amendment, claim 1 has been amended so as to use the term "support structure" to identify the feature exemplified by element 100 in Figs. 1-2, rather than the term

"support substrate." Also, claim 1 has been amended to include the recitation that the microelectronic device overlies the "second surface" of this support structure as formerly set forth in claim 12, as well as to refer specifically to the step of electrically connecting the microelectronic device to the posts, as previously set forth in claim 11. Manifestly, moving limitations between claims does not amount to an amendment which requires new discussion of support for the features set forth in the claims. However, support should be apparent from the discussion above and from Appendix A, attached hereto. Additionally, claim 1 has been amended to specifically refer to the support structure as including a dielectric. Here again, support is specified in Appendix A.

Also, by the present amendment, claim 1 has been amended to even further clarify that the first and second surfaces referred to are "oppositely directed first and second surfaces" of the support structure, and hence, the "second surface of said support structure" faces "away from said posts." Again, in, e.g., Fig. 2B, the first surface of the support structure faces upwardly, as shown in the drawing, and hence faces toward to the posts, whereas the opposite, second surface faces downwardly, toward microelectronic element 150 and faces away from the posts.

Claim 1 has been further amended to delete previous recitations concerning "base surfaces" of the posts and co-planarity of the top surfaces. These features have been moved to new claims 54 and 55, dependent from claim 1.

The remaining claims dependent from claim 1 have been amended for conformity with the language used in claim 1. In addition, claims 10 and 18 have been amended to replace the phrase "etch resistant" with --etch-resistant-- in order to be consistent throughout. Claim 12 has been further amended to replace the phrase "compliant layer" with the expression --

compliant structure--, as the compliant structure may be either a unitary layer 140 (Fig. 2A) or a layer including plural separate compliant pads 145 (Fig. 2B). The phrase "compliant structure" is clearly generic to both alternatives. New claims 52 and 53 have been presented to recite the specific alternatives.

New claim 51 has been added. This claim is generic to the particular species of connections between the posts and the circuit board set forth in claims 13 and 14. New claim 56 presents, in independent form, a claim corresponding to claim 3 (posts with edges) with the recitations of former claim 1, but without intervening claim 2 directed to an unrelated feature of the invention. New claims 57 and 58 are analogous to claims 54 and 55.

Also, the abstract has been amended to use the term "support structure" consist with the claims.

Claims 1-5, 7-9, 11-15, 18-20 and 48-50 were rejected under 35 U.S.C. § 102(b) on *Akiyama et al.*, U.S. Patent 3,801,388. This reference was newly cited by the Examiner in the Official Action. The Examiner's diligence in finding and adducing this reference is appreciated.

It is respectfully submitted that *Akiyama* does not meet present claim 1 under § 102, because *Akiyama* does not meet the recitation in amended claim 1 of "providing a microelectronic device so that said microelectronic device overlies said second surface of said support structure" in amended claim 1. The Official Action characterizes element 48 in Fig. 7F of the reference drawings as overlying "the inside of 42 which represents a second surface and remote from the posts 44." It is respectfully submitted that the "inside of 42" (the upwardly-facing surface of layer 42 in the reference drawings) could not be held to constitute the "second surface" referred to in amended claim 1. The amended claim clearly

characterizes the second surface as a surface directed oppositely from the "first surface," and explicitly characterizes the first surface as the surface from which the posts project. Assuming for purposes of argument that features 44 shown in the reference drawings constitute posts as referred to in the claim, the upwardly-facing surface of element 42 in the reference drawings would constitute the "first surface," whereas the downwardly-facing surface would constitute the "second surface." The reference does not mount a microelectronic element to that second, downwardly-facing surface, but instead mounts the alleged microelectronic element 48 on a part of the same surface which bears the asserted posts 44. For that reason, the reference cannot anticipate claim 1 under § 102.

Moreover, although no rejection under 35 U.S.C. § 103 has been advanced, it is pointed out that there is no suggestion whatsoever in *Akiyama* to relocate element 48 to the opposite surface of element 42. Indeed, the same is incompatible with *Akiyama*'s preferred structure, in which a further ceramic or conductive element 43 overlies this surface. See also element 6 in Fig. 1D; element 21 in Fig. 4F. More fundamentally, *Akiyama* does not suggest the arrangement as presently recited in claim 1, in which the microelectronic element and posts are disposed on opposite surfaces of the support structure, for the simple reason that *Akiyama* does not contemplate use of its structure as a mounting element for securing the microelectronic element to a further circuit board. The entire thrust and content of the *Akiyama* disclosure is directed towards making a structure which is, itself, the principal circuit board of the system. The *Akiyama* structure itself serves as a base circuit panel onto which other components may be mounted or connected as, for example, elements 47 and 48 in Fig. 7F. On this record, the only disclosure which would suggest placing a

microelectronic element on the second surface of the substrate, so that the posts project away from the microelectronic element as shown, for example, in Figs. 2A and 2B of the current drawings, comes from applicant's disclosure itself. As explained above and as believed clear from applicant's disclosure, with this structure, one can use the posts to secure the microelectronic element to a larger circuit board. However, nothing in *Akiyama's* disclosure has been pointed out as suggesting any such thing. Nothing in *Akiyama's* disclosure is seen as motivating one skilled in the art to relocate the alleged microelectronic element 48 to a location opposite from that shown in the reference. Applicant's disclosure, however, cannot be used to supply a suggestion missing from the reference itself.

Claims 2-5, 7-9, 11-15, 18-20 and 48-50, also rejected under 35 U.S.C. § 102(b) on *Akiyama*, distinguish over the reference for the same reasons, and accordingly the § 102(b) rejection should be withdrawn as to each of these claims for the same reasons as discussed with respect to claim 1. Moreover, as to claims 3 and 5 and as to new claims 56-58, the allegation in the Official Action that *Akiyama's* posts 44 have "at least one edge along the elongation direction as disclosed in the applicant's specification" is respectfully traversed as unsupported by the reference disclosure. No disclosure of such edges, or of the precise cross-sectional shape of *Akiyama's* alleged posts has been pointed out in the Official Action.

As to claim 12 and as to new claims 52 and 53, the allegation that element 48 in the reference is "attached to the substrate using an adhesive (col. 7, ln. 31) which is a compliant layer" is respectfully traversed as contrary to the reference teaching. At column 7, line 31, the reference states that element 48 is "attached to the other conductor members by face-bonding." Insofar as one can discern from the reference,

"face-bonding" refers to solder bonding terminals on a face of element 48 to the conductive members of the circuit board; it is synonymous with surface-mounting and does not necessarily (or even ordinarily) involve the use of any "adhesive." Further, nothing in the reference has been pointed out as showing that the postulated "adhesive" is "compliant."

Claims 13 and 14, as well as new claim 51, still further distinguish over *Akiyama*, inasmuch as each of these claims recites, in one form or another, the step of connecting the posts on the support structure to a larger circuit panel. No such step has been pointed out in *Akiyama*'s disclosure, and indeed such a step would be antithetical to the entire disclosure of *Akiyama*. Again, *Akiyama* itself makes a circuit board. No suggestion has been advanced as to why one would mount the circuit board of *Akiyama* to another circuit board using the posts or how one could so do. Moreover, such an arrangement would render the alleged posts 44 on *Akiyama*'s circuit board non-functional for their intended purpose in the reference disclosure. The referenced structures 44 serve to elevate a further conductor 37 above the plane of the circuit board so as to provide a bridge over a conductor (e.g., 34c; Fig. 7F) on the circuit board itself. It is not seen how one could mount the posts to another circuit board while still retaining this functionality. See also the similar "bridge" provided by members 8 supporting "second conductor member 4" above "first conductor member 3," so as to form a space 7 therebetween. (Col. 3, lns. 22-57.) This is the fundamental action sought by the reference and is incompatible with use of the posts to mount *Akiyama*'s circuit board to yet another circuit board. Other *Akiyama* posts serve to elevate discrete components such as capacitor 47 above the circuit board. Here again, mounting *Akiyama*'s circuit board to another circuit board by way of the asserted posts 44 and the similar structures in

the other embodiments would render these functions impossible. Surely, *Akiyama* does not teach or suggest any such thing.

As to claim 50, nothing in *Akiyama* has been advanced as teaching the step of providing the etch-resistant metal to form leads on the first surface of the dielectric support "before said step of coupling said conductive sheet to said first surface of said support structure." In *Akiyama's* disclosure, any leads which may be formed on the first surface of the support structure after completion of the process are formed by metal (e.g., 34a, 34c, 34d; Fig. 7C) carried on conductive sheet 31 of the reference structure. They are not formed on support structure or dielectric 42. For all of these reasons, the § 102(b) rejections should be withdrawn.

Claim 16 was rejected under 35 U.S.C. § 103(a) as unpatentable over *Akiyama* in view of *Goldman*, U.S. Patent 5,239,746, whereas claim 17 was rejected on *Akiyama* in view of *Goldman* "further in view of Lin et al (US 5,273,938)." However, neither *Goldman* nor *Lin* has been pointed out as teaching anything which would remedy the fundamental deficiencies of *Akiyama* noted above.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

If, however, for any reason the Examiner does not believe that such action can be taken at this time, it is respectfully requested that he telephone applicant's attorney at (908) 654-5000 in order to overcome any additional objections which he might have.

If there are any additional charges in connection with this requested amendment, the Examiner is authorized to charge Deposit Account No. 12-1095 therefor.

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Respectfully submitted,

By 

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